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ORIGINAL ARTICLE

A MODEL OF GPS BASED VEHICLE INFORMATION SYSTEM: A NEW INVENTION FOR VEHICLE CONTROL IN INDIA

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Abstract:

This paper embed the various GPS services into a system so that many problem related to transportation system can be resolved in real time by providing data and information into our own pre-set format and provide individual vehicle data such as location and velocity by using GPS, estimated time of arrival, the speed count, number of passengers and seat availability and these details can be sent to passengers by SMS using GSM technology. Till now a date, no such kind of a system is exists which provides all kind of a result we want for any types of vehicles. This research project is aimed to design with an embedded system which will use for tracking and positioning of vehicles with GPS. The initial data will be captured by GPS device. Again the captured data will be sent to one data cleaning device and finally it is considered as an input file for data parsing tool for analysis purpose. With the use of data parsing tool the next processing will be done. This project also uses sensors to detect the speed of vehicle, passengers present in the bus. The Microcontroller is programmed to control and display the information according to the received signal from the GPS and sensors placed satellite and the position of a satellite implies that the GPS receiver is on the surface of a sphere centered at the position of a satellite. Thus the indicated position of the GPS receiver is calculated.

KEYWORDS:

GPS, GSM, GPRS, Sensor

INTRODUCTION

Nowadays vehicle (BUS) is very important mode of transport to move from one place to other place. During the time of travel passengers face many problems such as seat availability, arriving time of bus and travelling time. The important objectives of this paper are:

1.Vehicle's real time parameter such as speed, current bus location, number of passengers in bus, seat availability is gathered and used for benefit.
2.Improve the quality of transportation system.
3.Developing Automatic Vehicle Location system using GPS for positioning information and GSM/GPRS or information transmission.
4.Tracking the driver's activity whether he/she is following the pre-define route and speed.
5.To send information about the location of vehicles (buses) to the passenger by SMS.
6.Getting the data into our pre-set format.

Our paper consists of GSM modem, level converter, microcontroller, Speed Sensor, passenger counter, display, power supply, GSM modem and data parsing tool. The data parsing tool helps us in getting

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the data and information into our required format. This paper embed the various GPS services into a systemwhich is used for tracking and positioning of vehicle by using the global positioning system (GPS) and using sensors to detect the speed of vehicle, passengers present in the bus. The Microcontroller is programmed to control and display the information according to the received signal from the GPS and sensors placedin the bus. GSM modem is used to transmit and receive information. Mobile is used to get the information about bus. When the people are sending SMS to bus unit, the GSM modem in bus unit receives the SMS and signal is given to level converter and level converted signal is given to microcontroller, which is used to process the signal. GSM modem is used to send the information to the mobile. The overview of the system is shown in fig 1.0.

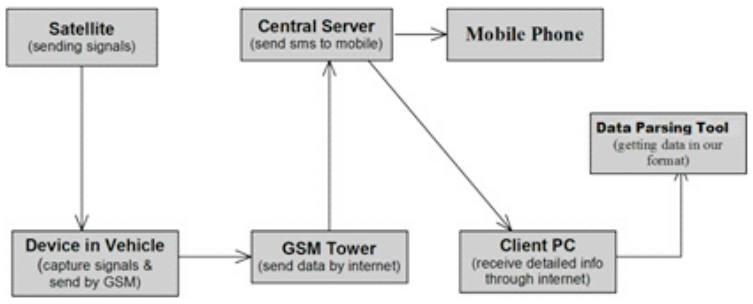

Figure 1.0: Overview of the System

Position calculation Through GPS:

To provide an introductory description of how a GPS receiver works, measurement errors will be ignored in this section. Using messages received from a minimum of four visible satellites, a GPS receiver is able to determine the satellite positions and time sent. The x, y, and z components of position and the time sent are designated as where the subscript i is the satellite number and has the value 1, 2, 3, or 4. Knowing the indicated time the message was received, the GPS receiver can compute the indicated transit time of the message. Assuming the message travelled at the speed of light, the distance travelled, can be computed. Knowing the distance from GPS receiver to a satellite and the position of a satellite implies that the GPS receiver is on the surface of a sphere centered at the position of a satellite. Thus the indicated position of the GPS receiver is calculated.

Global System for Mobile Communications:

Global System forMobile Communicationsis one of the widely used mobile standards. As the name specifies, it enables the mobile users to interact all over the world at any time.GSM was actually designed to be platform independent. Because GSM provides a common standard, cellular subscribers can use their telephones over the entire GSM area which includes all the countries around the world where the GSM system is used. In addition, the GSM provides user services such as high-speed data communication, facsimile and a Short Message Service (SMS). The GSM technical specifications are also designed to work with other standards as it guarantees standard interfaces.

The figure1.1 tells about the concept how to deliver the SMS to the appropriate receiver mobile. According to this paper the information about the location of the vehicle which is trapped is received by the GPS receiver then it is send to the user by using GSM technology.

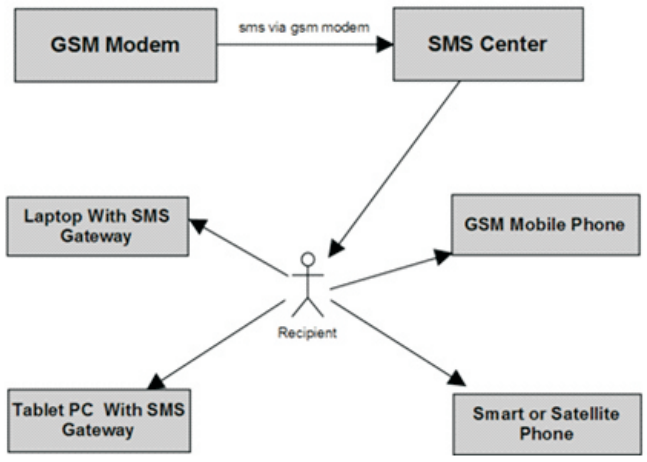

Figure 1.1: Delivering the SMS to the receiver mobile.

Counting Passenger Using Sensor

To count the No. of passenger in bus, we setup a pair of sensors on the doors of vehicle (bus) i.e. on the front and back door which is connected to GPS device installed in vehicle. In this case we consider that the front door of bus will be used for passenger entry and rear door of bus will be used for passenger exit,if any passenger enters into the bus from front door then the set counter increases by 1 and if any passenger get out from the rear door of the bus then the set counter reduced by 1. Therefore, the sensors automatically are able to count the number of incoming and outgoing passenger in real time and data is sent to the database.

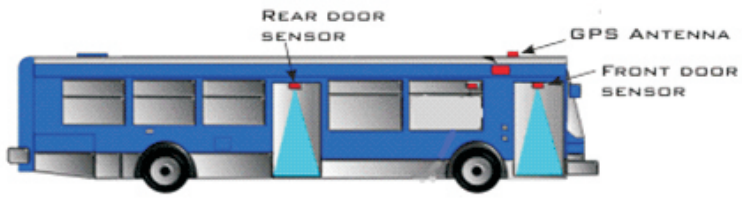

Figure 1.2: Sensor System on Bus

Proposed Work:

The system being proposed makes use of the GSM and GPS technologies that allows the system to track vehicle and provides the most up-to-date information. The system tasks advantage of wireless technology in providing powerful management transportation engine. Overall system is partitioned into two major design units.

1.Vehicle unit
2.Tracking Server

This system is based on a stand-alone single-board embedded system that is equipped with GPS and GSM modems that is installed in the vehicle.

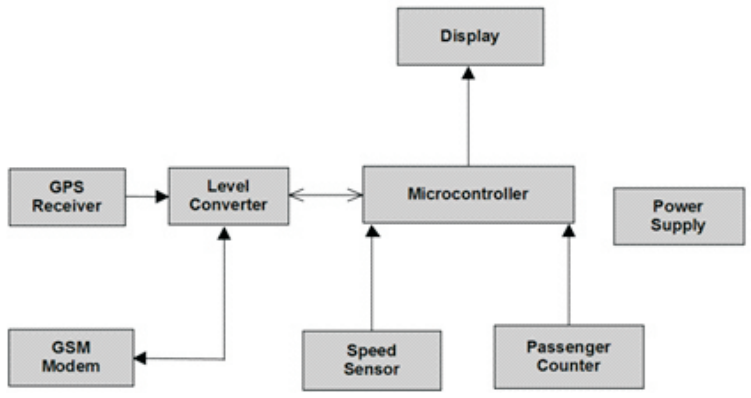

Figure 1.3: Block Diagram of Vehicle Unit

Vehicle Unit:

This is major part of the system and it will be installed into the vehicle. It is responsible for capturing the
Following information for the vehicle
1.Current location of vehicle.
2.Speed of the vehicle.
3.No of passenger in vehicle(bus)

Vehicle unit is also responsible for transmitting this information to Tracking Server located anywhere in the world.

Data Transceiver:

When all required information is extracted and processed, it needs to be transmitted to a remote. Tracking Server which will be able to display this information to the end user. For real time tracking of vehicle, reliable data transmission to remote server is very important. Wireless network is required to transmit

Vehicle information to remote server. Existing GSM network is selected to transmit vehicle information to remote server because of broad coverage of GSM network. It is also cost effective rather than to deploy own network for transmission of vehicle information. For data transmission over GSM network GSM modem is required. GSM modem can send and receive data SMS text messages and GPRS data over GSM network. Location data is transferred to microcontroller through serial interface. After processing of the data provided by GPS receiver, microcontroller transmits this information to remote location using GSM/GPRS modem. Microcontroller controls the operation of GSM/GPRS modem through serial interface using AT commands.

Software flow:

Microcontroller is acting as Central Processing Unit for Vehicle unit. All operations of the In-Vehicle Units are to be controlled by the microcontroller. Microcontroller needs instructions to operate the whole System. These instructions are provided to microcontroller by writing the software into microcontroller's flash memory. It reads the software instruction by instruction and performs the action as required by instruction.

Tracking Server:

Tracking server maintains all information received from all Vehicle units installed in different vehicles into a central database. This database is accessible from internet to authorized users through a web interface. Authorized users can track their vehicle and view all previous information stored in database. Tracking server has a GSM/GPRS modem attached to it that receives SMS from Vehicle units and sends those messages to the server through serial port. Tracking server saves this information into database.

Managing Database and Interface Design:

Tracking Server maintains all information in a database. To display this information to users front end software is required that can display all information to the user. The system is being installed the

Vehicle unit in his vehicle and also the administrator of the system who is managing Vehicle Tracking System. There may be a number of vehicles installed with In-Vehicle units therefore server must be able to manage and distinguish information sent by all In-Vehicle units. For this purpose information must be available to server about all vehicles that are installed with In-Vehicle units. Whenever In-Vehicle unit isinstalled, information about that vehicle is stored in the database. Web interface must also support thisfunctionality. Since web interface will be accessible over the internet therefore access must be restricted toauthorized users only. Therefore information about all users of the system must be stored in database.

Data Parsing (Getting data in our own required format):

The GPS device give the output in the simple text format, that contains time, position, and velocity data and other required data in the fixed width fields (not delimited) defined in the following table:

FIELD DESCRIPTION:	WIDTH:	NOTES:
Sentence start	1	always '@'
Year	2	Last 2 digits of UTC year
Month	2	UTC month,"01"..."12"
Day	2	UTC day of month, "01"..."31"
Hour	2	UTC hour, "00"..."23"
Minute	2	UTC minute, "00"..."59"
Second	2	UTC second, "00"..."59"
Latitude hemisphere	1	'N' or 'S'
Latitude position	7	WGS84 ddmmmmm, with an implied, decimal after the 4th digit
Longitude hemisphere	1	'E' or 'W'
Longitude position	7	WGS84 dddmmmmm with an implied, decimal after the 5th digit
Altitude sign	1	'+' or '-'
Altitude	5	Height above or below meansea level in meters
Sentence end		The initial data captured by the GPS device is shown in the figure 1.4.

```
@040703112755S2933200E03017304g017+01149E0000N0000U0033
@040703112756S2933200E03017304g017+01149E0000N0000U0033
@040703112757S2933200E03017304g017+01149E0000N0000U0033
@040703112758S2933200E03017304g018+01149E0000N0000U0030
@040703112759S2933200E03017304g018+01149E0000N0000U0027
@040703112800S2933200E03017304g019+01149E0000N0000U0026
@040703112801S2933200E03017304g019+01149E0000N0000U0026
@040703112802S2933200E03017304g019+01149E0000N0000U0026
@040703112803S2933200E03017304g019+01149E0000N0000U0026
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@040703112809S2933201E03017304g021+01149E0000N0000U0021
@040703112810S2933201E03017304g021+01149E0000N0000U0021
```

Figure 1.4: GPS data captured by the data logger.

The data we are getting at initial phase is very complex and difficult to understand, so by using data parsing technique, the initial data is simplified and arranged according to pre-set format by which one can get data in whatever format he/she wants.

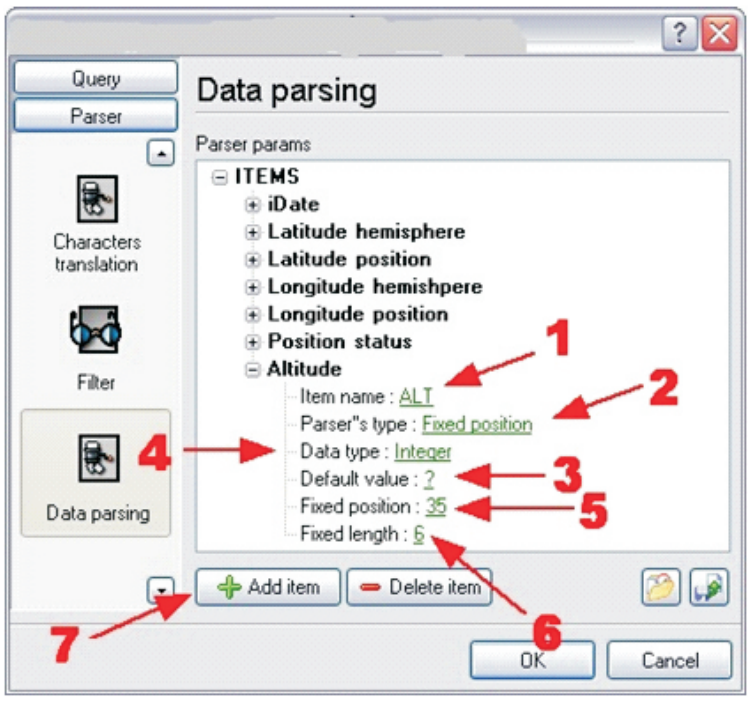

Figure 1.5: Data Parsing

CONCLUSION:

Using and implementation of this embed GPS system is very easy. Byusing this system the vehicle tracking will be completed. The number of passengers inside the bus is found keeping infrared sensors in the footsteps. The seats available in bus will be found by number of passengers inside the bus and the information about the location, speed count, seat availability is informed to the passengers using SMS.The advantages of the system is that all the people willget the information easily, we can easily track the vehicle location as well as activity of driver. Implementation of this system will help to reduce the corruption also. This system is quite hard to implement on all the buses especially in India as the condition of buses in India is not so good but it is not impossible. We can implement it on the buses which provide good facility and which are in good condition for example: low floor buses of Delhi, Shivneri buses and many more. After that we can try to implement it on all the buses and help to provide this system to all.

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